Plastic Surgery
2018, Vol. 26(3) 169-222

DOI: 10.1177/2292550318781840
journals.sagepub.com/home/psg

Groupe pour l'avancement de la microchirurgie Canada (GAM) Abstracts presented at the 38th Annual Meeting / Résumés présentés au 38e congrès annuel

Dr. Edward Buchel: President / Président and Dr. Kirsty Boyd: Secretary / Secrétaire

02 - Uncovering Synergistic Predictors of Complications in Microvascular Breast Reconstruction: A Retrospective Cohort Study

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Purpose: Microvascular breast reconstruction is a complex procedure that can be associated with high complication rates. While a number of individual predictors of postoperative complications have been identified, few studies have explored interaction between risk factors. Understanding the synergistic effects of multiple risk factors is central to accurate and personalised preoperative risk prediction. **Methods:** We conducted a retrospective cohort study of patients who underwent microvascular breast reconstruction at our institution between 2009 and 2017. All intraoperative or postoperative complications were recorded. A multivariable logistic regression exploratory model identified independent predictors of complications. Interactions between individual variables were then assessed using the Relative Excess Risk Index (RERI) and Synergy Index (SI). **Results:** Nine hundred twelve patients were included in the study and 26.1% experienced at least 1 intraoperative or postoperative complication. Obesity (OR: 1.54, $P = .01$), immediate reconstruction (OR: 1.49, $P = .03$), and comorbidities (OR: 1.43, $P = .03$) were identified as independent predictors of complications. Obesity and comorbidities had significant synergistic interactions with immediate reconstruction (RERI: 0.86, SI: 2.35, $P = .0002$; RERI: 0.54, SI: 1.78, $P = .001$), bilateral reconstruction (RERI: 0.12, SI: 1.15, $P = 0.002$; RERI: 0.59, SI: 3.16, $P = .01$), and previous radiotherapy (RERI: 0.62, SI: 4.43, $P = 0.01$; RERI: 0.11, SI: 1.23, $P = .04$). Smoking had a synergistic interaction with immediate breast reconstruction (RERI: 1.99, SI: 4.36, $P = .03$). **Conclusion:** Patient- and treatment-related variables interact in a synergistic manner to increase the risk of complications for microvascular breast reconstruction. In light of the known multifaceted repercussions of complications, individualized comprehensive risk assessment should guide surgical decision-making and patient counselling. **Learning Objectives:** (1) Participants will be able to identify independent predictors of complications for deep inferior epigastric perforator (DIEP) flaps in oncologic breast reconstruction. (2) Participants will be able to recognize higher risk oncologic breast reconstruction surgical candidates by identifying synergistic risk factors for complications.

03 - The Role of Postoperative Anticoagulation in Digital Replantation or Revascularization

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Purpose: The use of intravenous (IV) heparin following digital replantation or revascularization (DRR) varies greatly. The insufficient evidence lacks the clinical equipoise needed for a randomized trial; as such, a matched propensity score analysis was performed to evaluate the use of postoperative heparinization following DRR. **Method:** A retrospective cohort of patients who underwent DRR from 2005 to 2016 was identified. A propensity score was calculated based on age, smoking, injury mechanism, procedure type, vein graft, and number of digits injured. Patients were matched 1:2 by 0.2 standard deviation caliper width of the logit of the propensity score to create 2 groups of patients with similar risks of receiving IV heparin or dextran postoperatively. Generalized estimating equation logistic model was used to determine differences in failure rates between groups. **Results:** DRR was performed on 282 (92% male; median age: 43 years) patients. Postoperative heparin was administered in 69 (24%) patients, with continuous IV heparin in 34 patients and IV heparin with dextran in 35

patients. Digital failure occurred in 88 (31%) patients, of whom 38% received IV anticoagulation. Major complications were higher among the anticoagulated patients (13% vs 3.3%). After propensity score matching, use of anticoagulation was not found to be associated with protection against digital failure (OR: 0.79, 95% CI: 0.47-1.32). **Conclusion:** Among DRR patients with similar predisposing characteristics for postoperative therapeutic heparin or dextran, the use of therapeutic anticoagulation does not appear to have a protective effect against digital failure. Studies are needed to define the role of postoperative IV anticoagulation in DRR and to justify the risk of its administration. **Learning objectives:** (1) Discuss propensity score matching. (2) Discuss the role of anticoagulation in digital replantation or revascularization.

04 - Investigating Patients' Perception of Microvascular Free Toe Flap for Reconstruction of Amputated Thumbs: A Guide for Surgeons During Informed Consent

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Purpose: After thumb amputations, restoration of function and aesthetic can be accomplished with microvascular free toe flaps. However, many patients do not opt for this reconstruction, despite positive reported outcomes. This study aims to determine patients' perceptions of free toe flaps in order to improve the delivery of informed consent. **Method:** A retrospective survey was administered to patients with thumb amputations. Participants were required to complete a questionnaire about patient demographics, the Brief Michigan Hand Questionnaire (bMHQ), the standard gamble/time trade-off questionnaires for utility scores, and a questionnaire investigating potential reasons for electing not to undergo a free toe transfer. **Results:** Thirty patients were enrolled in the study, wherein 53% underwent a replantation procedure, 27% a revision amputation, and 20% a delayed reconstruction. The mean normalized score on the bMHQ was recorded as 63.54. Utility questionnaires yielded mean measures of 0.8967 and 0.86 on the standard gamble and time trade-off, respectively. From 14 elements, a majority (87%) stated flap failure as a major source of concern, followed by lack of understanding of risks and benefits (80%) and prolonged hospital stay (53%). Cultural/religious beliefs, aesthetic appearance of the foot, and concerns about footwear were not reported as important reasons in 90%, 80%, and 79% of patients, respectively. **Conclusions:** A better understanding of patients' attitudes and beliefs with respect to free toe flaps will allow surgeons to better address their concerns during informed consent. This study emphasizes the importance to discuss about failure rates, risks, and benefits of the operation and prolonged hospital stay. **Learning Objectives:** (1) Participants will be able to rank several arguments influencing the decision to undergo a free toe flap from the patients' perspective. (2) Participants will be able to determine the utility of free toe flaps as rated by patients with a previous thumb amputation.

05 - Microsurgical Reconstruction in the Pediatric Population: A Systematic Review

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Purpose: Differences in microsurgical reconstruction for pediatric and adult patients have not been defined in a unified format for clinical application. This systematic review summarizes differences in surgical planning, perioperative management, and outcomes comparing these populations. **Methods:** A PubMed search for articles of pediatric microsurgical reconstruction was performed. Data collected included age, indication for free flap, type of free flap, anatomic specifications, perioperative adjuncts, complications, and functional outcomes. Descriptive and pooled analyses were used to summarize considerations for flap selection, complication rates, and functional outcomes. **Results:** A total of 473 articles were reviewed and 45 articles included, according to a priori selection criteria. This review summarizes data of over 500 pediatric microvascular transfers. Indications for treatment, in the order of decreasing frequency, were reconstruction for traumatic injury, congenital deformity, and oncologic resection. Anatomic variation and vascular agenesis are recognized in specific congenital deformities. Regional anesthesia safely improves perioperative care and reduces vasospasm. Pooled mean success rate of 96% in pediatric free flaps is comparable to that in adult patients ($P > .05$). Salvage rate, flap failure, and partial flap loss did not differ between age-groups ($P > .05$). Venous insufficiency is the most common cause of flap takeback and flap loss in pediatric cases. Risk of gait difficulty and malocclusion are important considerations for flap selection and timing of reconstruction of osseous defects. **Conclusion:** Flap reliability is similar in children compared to adults for osseous, myogenous, perforator, and composite flaps. Anticipated growth of the long bones and craniofacial skeleton influence the timing, flap selection, functional outcomes, and risk of donor site complications. **Learning Objectives:** (1) The learner will be able to describe important considerations in surgical planning in pediatric patients undergoing microsurgical reconstruction. (2) The learner will be able to describe the influence of growth in flap selection and timing of reconstruction.

06 - Outcomes Following Coronary Artery Bypass Grafting With Microsurgery in Pediatric Patients

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Purpose: Pediatric coronary artery bypass grafting (PCABG) is indicated in cases of clinically significant and symptomatic coronary stenosis. PCABG presents unique surgical challenges for surgeons, including the small vessel caliber and anomalous coronary vasculature. Serious perioperative complications are common. To reduce complications and improve outcomes of these procedures, surgical microscopes have been used at our centre with the anastomosis performed by a microvascular surgeon. The purpose is to provide a detailed technical description and report our institutional experience for all patients who have undergone PCABG procedures with and without microvascular techniques. **Methods:** Twenty-four patients who underwent PCABG from 2000 to 2017 were retrospectively reviewed. Variables assessed included basic demographic data, diagnosis, preoperative echocardiography and angiography, details of PCABG and any associated procedures, perioperative complications, graft patency, and clinical and functional outcomes. **Results:** Eighteen patients underwent bypass without microvascular involvement and 6 patients required the use of microsurgical techniques. Median age at operation was 9.79 years (range: 2.15-16.2 years) and 2.02 years (range: 0.27-4.44 years) for the 2 groups, respectively. Median weight at operation was 41.2 kg (range: 11.8-85.7 kg) and 10.75 kg (range: 4.6-14.0 kg) for the 2 groups, respectively. Three major anastomotic complications occurred requiring reoperation, although none occurred in the microvascular group. Median follow-up was 3.40 years (range: 0.1-8.25 years) and 5.25 years (range: 1.92-12 years) for the 2 groups, respectively. Three patients were symptomatic at last follow-up and 2 deaths occurred, all in the nonmicrovascular group. All grafts were patent in both groups. **Conclusion:** Our results highlight the potential positive impact of collaboration between cardiac and microvascular surgeons during PCABG procedures and the subsequent reduction in complications that may be expected. Larger studies with age-matched controls are required to determine whether microsurgical involvement in PCABG improves outcomes. **Learning Objectives:** (1) Understand the rationale, technique, and outcomes of microvascular involvement in PCABG.

07 - Sartorius Nerve Transfers: A Cadaveric Anatomical Study and Clinical Cases

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Purpose: Lower extremity nerve transfers are a relatively new undertaking in the field of peripheral nerve surgery. Thus far, transfers using sartorius branches of the femoral nerve as donors have not been reported. This study describes the anatomy of the sartorius nerves and reports on several patients treated with sartorius to quadriceps nerve transfers. **Method:** Four fresh-frozen cadaver extremities were dissected for anatomical analysis including surface anatomy landmarks, branching patterns, and axonal counts of the sartorius nerves. A retrospective review of patients with post-traumatic quadriceps weakness treated with sartorius nerve transfers was conducted. Preoperative and postoperative MRC strength and patient-reported outcomes were evaluated. **Results:** Five nerve branches innervate the sartorius muscle in its proximal third, all branching from the femoral nerve at or just proximal to the inferior aspect of the inguinal ligament. On average, the first branch entered the muscle 5 cm below the inguinal ligament and the most distal branch 12 cm below. The sartorius branches were always the most superficial of the femoral nerve branches. Axon counts are pending. Three patients (aged 14-50 years) underwent femoral nerve decompression and supercharge end-to-side nerve transfers of the sartorius branch to quadriceps (vastus medialis, vastus lateralis, or rectus femoris). The injury etiology included gunshot wounds (n = 2) and iliopsoas compartment syndrome (n = 1). At 3 to 6 months post injury, all patients demonstrated profound weakness with partial recovery (MRC grade 2 to 3/5 for knee extension). Postoperatively, knee extension strength ranged from 4 to 4+/5 at last follow-up. All patients had reduction in preoperative pain, with 2 having complete resolution. **Conclusion:** The sartorius nerve branches of the femoral nerve are easily identified and are suitable donors for nerve transfers for restoring quadriceps function in partial femoral nerve injuries. With significant redundancy in sartorius innervation and function, oftentimes several branches can be utilized with little morbidity. **Learning Objective:** To demonstrate the technique and utility of performing sartorius to quadriceps nerve transfers.

08 - Economics of Lymphovenous Bypass

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Purpose: The objective of this study was to compare the economic impact of complete decongestive therapy (CDT) and lymphovenous bypass (LVB) in the management of extremity lymphedema. **Methods:** Economics were modeled for a patient with extremity lymphedema undergoing 3 different clinical pathways: (1) CDT alone, (2) LVB no longer requiring ongoing CDT, and (3) LVB requiring ongoing CDT. Activity-based cost analysis identified fixed and variable costs incurred with CDT and LVB. Costs were retrieved from supplier price lists, physician fee schedules, and lymphedema therapists. Literature reviews were executed to quantify (1) perioperative and operative costs of microsurgery, (2) time required for LVB, and (3) the likelihood of discontinuing CDT following LVB. The net present value (NPV) of all costs incurred for each clinical pathway was calculated. Sensitivity analysis was performed to identify key variables influencing the economic model. **Results:** The NPV of all costs for a patient with extremity lymphedema undergoing treatment was (1) CDT alone ($30 000), (2) LVB no longer requiring ongoing CDT ($14 000), and (3) LVB requiring ongoing CDT ($42 000). Taking into account the likelihood of discontinuing CDT following LVB, the NPV of all costs for LVB was $26 000. Sensitivity analysis

demonstrated the following variables to have the greatest impact on treatment economics: life expectancy, likelihood of discontinuing CDT, discount rate, and inflation rate. **Conclusion:** Lymphedema has substantial ongoing costs irrespective of the treatment modality. Taking into account the potential for patients to discontinue CDT following surgery, the cost of LVB appears favorable compared to CDT alone. The additional surgical costs of LVB are offset by the savings from discontinued ongoing therapy. Despite its limitations as a theoretical economic model, this study provides insight into the potential economic impact of treating lymphedema with LVB. **Learning Objective:** Participants will understand the economic costs of lymphedema treatment.

09 - How to Assess a New Lymphedema Consult: Considerations for Lymphaticovenular Bypass and Lymph Node Transfers

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Purpose: Lymphedema can have devastating physical and psychosocial consequences in affected individuals. Classic manifestations range from subjective concerns, such as general limb discomfort, to increased limb circumference with fluid accumulation, changes in fat deposition, and skin quality. Patients also remain at constant risk of developing severe cellulitis that can result in life-threatening sepsis. These findings stem from altered lymphatic channel contractile function and eventual loss of patency. Restoring lymphatic outflow and promoting the growth of new channels underlie the mechanisms behind physiologic microvascular procedures, such as lymphaticovenular bypass and lymph node transfers, respectively. Evaluation of lymphatic channel function, fluid accumulation, and fat hypertrophy is central to understand whether these techniques may offer benefit. The purpose of this study is to describe our experience on how to assess patients with lymphedema for physiologic or reductive procedures and objectively appraise outcomes. **Methods:** All new patients presenting with lymphedema receive a validated questionnaire (LYMQOL) and clinical examination, including limb volume measurements and an assessment for pitting edema and venous stasis. The involved region is further characterized by indocyanine green (ICG) laser angiography and a magnetic resonance lymphangiogram (MRL) at baseline. **Results:** ICG-based laser angiography offers a portable, office-based means of observing lymphatic function and common pathologic flow patterns. MR-lymphangiogram aids in further mapping lymphatic channels and identifying the presence of fluid accumulation and fat hypertrophy. **Conclusions:** Patent lymphatic channels and absent venous hypertension are requirements for lymphaticovenular bypass. Lymph node transfers may be considered in patients who fail bypass operations or who have undergone lymph node dissections. Reductive procedures such as liposuction have utility in treating fat hypertrophy. **Learning Objectives:** Participants will develop an approach on how to clinically assess the patient with lymphedema. Technical pearls on performing ICG injections and interpreting ICG and MRL images will be discussed.

10 - GAM-TSG Scholarship Lecture

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The microsurgery fellowship at Memorial Sloan-Kettering Cancer Center (MSKCC) has undergone significant evolution in recent years. While it remains a premier center for alloplastic reconstruction, capacity expansion has facilitated significant growth in microvascular case volume and diversity. This presentation will highlight the overall fellowship experience as well as provide an update on current areas of clinical interest and research at MSKCC, including virtual surgical planning for dental rehabilitation in head and neck reconstruction, alternatives to abdominal flaps for breast reconstruction, microvascular solutions for partial breast reconstruction, and lymphedema. **Learning Objectives:** Highlights of the microsurgery fellowship at Memorial Sloan Kettering Cancer Center will be discussed.